

Community Partnerships: Review of Selected Models and Evaluation of Two Case Studies

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ABSTRACT Risks for cardiovascular diseases (CVDs) are established early in life with behavior patterns associated with diet and physical activity. Establishing healthy behavior patterns among children, and providing the environmental supports necessary to maintain them, has the potential to reduce future risks for chronic diseases. This paper reviews the literature on collaborative partnerships formed to address similar issues. The authors describe the evaluation of school and community partnerships facilitated by the Kansas LEAN School Intervention Project, which had the mission of reducing risks for chronic diseases, including CVDs and some cancers, among children. A multiple case study design was used with collaborative partnerships in two communities in Kansas. The results suggest that the partnerships facilitated important changes in the schools and communities. We discuss challenges and opportunities in the evaluation of school and community partnerships for health.

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INTRODUCTION

Risks for cardiovascular diseases (CVDs) begin early in life. Based on assessments of students in six public schools in New York City, researchers estimated that by age 12, approximately 40% to 60% of children have at least one modifiable risk factor for coronary heart disease.¹ Diet and exercise patterns,

strong contributors to risk for heart disease, are influenced by multiple environmental conditions such as the availability of healthful foods or exercise opportunities, peer influences, media, and family practices.²

Collaborative partnerships offer a mechanism for individuals to change community conditions that affect health.³ They engage diverse community groups, use multiple strategies, and work together to achieve a common purpose.⁴ Partnerships are alliances in which all share risks, responsibilities, resources, and rewards for the common effort.⁵ School and community partnerships might be especially well suited for reducing children's risk for chronic diseases. Within schools, teachers, foodservice personnel, and coaches can have substantial influence over children's opportunities for healthful diet and exercise. Similarly, within the broader community, restaurateurs, grocers, and parents can promote healthy environments. Collaboratively, these partners have the power to implement changes (e.g., new or modified programs, policies, and practices) in the school and community to improve children's diet and exercise patterns. There are a number of models for developing collaborative partnerships for community health. Comprehensive models include components to increase awareness (e.g., through newsletters or special events), change lifestyles (e.g., skill building or incentives), and create supportive environments (e.g., changing norms or creating new opportunities for healthier eating and exercise).⁶ Several illustrative models are discussed in this paper.

PATCH programs. The Centers for Disease Control and Prevention (CDC) developed the Planned Approach to Community Health (PATCH) program based on the PRECEDE-PROCEED model.⁷ PATCH provides training and workbooks that help identify and contact key community members, generate funds and human resources, and develop a plan for action. Although there are hundreds of community applications of the PATCH process, according to M. Kreuter (personal communication, May 1996), few have been carefully evaluated. Strengths of the PATCH program include the availability of detailed manuals and handbooks and the poten-

Work was conducted in the Kansas communities of Salina and Dighton in conjunction with Unified School Districts 305 and 482.

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tial for developing relationships among communities, health departments, and the CDC. However, procedures for implementing PATCH are somewhat complex, requiring extensive technical assistance or local expertise.³

Healthy Cities. The World Health Organization's Alma-Ata conference on primary care created global awareness of the importance of community influence over health care, emphasizing the importance of preventive intervention and the value of "health for all."^{8,9} The goals of Healthy Cities projects include forming and acting on comprehensive plans for health that involve many community sectors. For example, Healthy Cities Indiana, a six-city initiative founded in 1988, had by 1992 developed a walking program, health public service announcements, and long-range plans for solid waste recycling and crime watch programs.¹⁰ No effects on key outcomes have been reported for Healthy Cities. Strengths of the Healthy Cities model include emphasis on collaboration, participation from multiple sectors of the community, and the potential for support and communication within the Healthy Cities network. Weaknesses of the model include poor documentation of procedures, lack of a targeted mission, and heavy emphasis on planning, with little evidence of implementation or evaluation of outcomes.

Urban community development model. This model is based on principles of community development.¹¹ A designated lead agency convenes city-wide leadership, professionals, and neighborhood groups in a three-tiered partnership designed to strengthen the "social infrastructure" of the city. Partnership staff guide groups through member recruitment and collaborative planning to increase communication and accountability between leaders and constituents of communities. An academic center provides an enabling system that includes leadership training, staff training and supervision, state-wide meetings, and consultation. Initial applications were designed to reduce alcohol and drug abuse. No effects on health outcomes have been reported for this model. Strengths of the model include high citizen involvement, systematic technical assistance for sites,¹² and the inclusion of people most affected by the issue in planning and implementation. Limitations to date include no measures of effects on outcomes or whether "social infrastructures" have been strengthened.

University of Kansas (KU) Work Group model of health promotion through community development. This model was initially developed to support the Kansas Initiative, a state-wide health promotion program sponsored by the Kansas Health Foundation.³ This model has been used to address the prevention of adolescent pregnancy,¹³ adolescent substance abuse,¹⁴ and cardiovascular risk reduction.¹⁵ Model developers provide manuals¹⁶⁻¹⁸ and other forms of support in five phases of partnership development, including collaborative planning, collaborative action, community change, capacity building and health outcomes, and institutionalization and renewal.¹⁹ Community involvement includes representatives from numerous agencies and organizations, such

as schools, health professionals, business, and civic organizations. Six ongoing case studies for prevention of adolescent pregnancy and substance abuse established in 1993 have shown hundreds of changes in programs, policies, and practices consistent with their missions, such as a summer youth employment program, increased access to contraceptives, ongoing alternative activities, and ordinance changes. Although outcome data are preliminary, an earlier study of a substance abuse partnership showed an apparent relationship between high rates of community change and the community-level indicator of single-night-time vehicle crashes (SB Fawcett, RK Lewis, A Paine-Andrews, et al., unpublished data, 1995). Strengths of the model include manuals for action planning and monitoring and evaluation, a coupling of technical assistance and evaluation,²⁰ and a measure of community change that provides regular feedback to partnerships on how well they are mobilizing citizens for change.²¹ Limitations include somewhat complex monitoring and evaluation procedures that require either substantial local expertise or external support to implement.

To date, no individual model embodies the high road to community health. PATCH and the KU Work Group model provide extensive materials for conducting collaborative planning. The Urban Community Development Model and the KU Work Group model have outlined enabling systems for supporting community development. Healthy Cities has mobilized the upper echelons of communities across the globe; the Urban Community Development Model fosters the involvement of marginalized citizens who are usually left out of the social planning loop. All of the models are currently implemented in multiple communities. None of the models has demonstrated favorable health outcomes in multiple sites, which might be considered the hallmark of an effective model. This might be due to the fact that most of the health outcomes targeted by these programs take many years to accrue. Large-scale community-based interventions in the 1970s and 1980s required 5 to 10 years to demonstrate reductions in risk factors for chronic diseases.³

It is difficult to detect the effects of community partnerships. Partnerships often deliver a multitude of community interventions that target high-risk individuals, all individuals, and the environment in which individuals make health-related choices. The sum of these community interventions represents the degree to which a community has been transformed into a more health-promoting place that makes health-related choices easier.²² Given that evidence of health outcomes may take many years to accrue, a core evaluation issue involves identifying an intermediate measure of partnership outcomes.

This paper describes an evaluation of the processes and intermediate outcomes of school and community partnerships for reducing risks for chronic diseases such as CVD and some cancers among children. A multiple case study design²³ was used to examine the effects of two partnerships on school and community changes related to the mission. The community partnerships were in Salina (population 42,300) and Dighton (population 1400), Kansas. This effort was part of the Kansas

LEAN School Intervention Project, sponsored by the Kansas Department of Health and Environment and the Kansas Health Foundation. This evaluation was designed using the KU Work Group model of health promotion through community development.

METHODS

Context of the community partnerships and support organizations. Kansas LEAN, a program of the Kansas Department of Health and Environment, Bureau of Chronic Disease and Health Promotion and the Kansas Health Foundation, designed and facilitated the implementation of the Kansas LEAN School Intervention Project. Kansas LEAN has the mission of reducing chronic disease among Kansans through community-based prevention efforts.¹⁵ The KU Work Group provided technical assistance and evaluation for the project. The Kansas Health Foundation provided a 2-year grant (\$155,454) to design, pilot test, and evaluate a comprehensive chronic disease prevention program for youth in two communities. Kansas LEAN conducted focus groups with representatives from potential intervention communities throughout the state to provide background for developing the project.

Kansas LEAN School Intervention model. The Kansas LEAN model consisted of forming partnerships to make changes in schools and the broader community. In addition, there were three school-based components: (a) modifying school lunches, (b) enhancing nutrition education, and (c) increasing opportunities for physical activity. This paper focuses on evaluating the community partnership; methods for evaluating the specific school-based components, as well as the evaluation results, are described elsewhere.²⁴ Each community partnership consisted of various community sectors, such as government or business, coming together to support the school-based changes and to bring about changes in the broader community so that children and their families would have additional opportunities outside of school to select lower fat foods and participate in fitness activities.

Kansas LEAN hired on-site coordinators to facilitate intervention activities. These on-site coordinators were registered dietitians who worked approximately 20 to 30 hours per week. On-site coordinators initiated the partnerships by recruiting parents, teachers, business leaders, and other community members to participate. Coordinators also provided leadership for the group. The partnerships in Salina and Dighton emerged in different forms. Collaborators in the Salina project included existing organizations with similar missions (e.g., YWCA, the American Heart Association), local restaurants and grocery stores, and food distributors (e.g., Tony's Pizza). In Salina, the partnership held few formal meetings. The on-site coordinators discussed community needs with the partners and served as a broker, conveying ideas and assistance among partners. Existing programs were expanded

or modified to increase opportunities for physical activities and healthy eating for school-aged youth and their families.

Project collaborators in Dighton included local media representatives (the newspaper editor and cable television manager), a senior citizens' group, a sports medicine specialist, the local grocery store, preschool providers, sports coaches in all schools, the local public library, the local health department, the local extension office, parents, teachers, and representatives from the local school board. For the first 6 months, the partners met bimonthly as an entire group to develop goals and action steps for each of the four project components. Partners then formed multiple task forces to work toward implementing the goals. The task forces selected chairs and met independently. Chairs of the task forces reported progress to the coordinator informally on an ongoing basis and to the entire partnership quarterly. Few exercise facilities were located in Dighton. To increase fitness opportunities, partners focused on developing new programs, such as a noncompetitive annual track meet for young children, and enhancing sports opportunities for girls.

The community partnerships had two main functions: (a) supporting and enhancing implementation of major project components in schools (e.g., modifying school lunches and increasing opportunities for physical activity) and (b) serving as a catalyst for changes in the broader community to reduce risks for chronic diseases. These changes were intended to (a) raise the level of awareness of children's risk for chronic diseases, (b) provide information about how to reduce risks for CVD, (c) provide opportunities to engage in protective behaviors, such as regular physical activity and eating healthier foods, and (d) enable the school and community to maintain and expand efforts when the project ended.

Measurement system. Project evaluators and staff negotiated the key questions and measures used to evaluate the project by considering (a) what outcomes were important to the staff and funders, (b) what information would facilitate midcourse corrections, (c) what changes would likely be detectable (such as new or modified programs, policies, and practices), and (d) what measures were feasible to use.

Project staff and leadership selected several key questions related to the community-based partnership, including (a) were changes in the community facilitated by the partnerships? (b) how well were the partnerships implemented? (c) were the goals of the partnerships important? and (d) were community changes important to reducing children's risks for chronic diseases? Evaluators used a monitoring system and constituent surveys to address these questions. Although detailed measurement procedures are discussed elsewhere,¹⁸ the measures, methods for data collection, feedback systems, and case study designs are briefly described in the sections below.

Log monitoring system. For 2 years, project evaluators used a monitoring and feedback system²¹ to document the partnerships' activities (e.g., services provided and community actions) and to track how the school and community became

more health promoting by increasing opportunities for healthy choices (community changes). Services provided are defined as events designed to provide information, instruction, or develop skills of people in the community (e.g., ongoing basketball programs, menu planning classes). Community actions are defined as actions taken in the school or community to bring about new or modified programs, policies, or practices to reduce risks for CVDs (e.g., meeting with teachers to revise curricula). Community changes are defined as new or modified programs, policies, or practices in the school or community that are facilitated by the partnership and reduce risks for CVDs (e.g., adopting a new physical education curriculum). Table 1 provides selected example community changes facilitated by the two community partnerships.

To complete the logs, project evaluators made weekly or monthly phone calls to partnership staff about activities and accomplishments. Information about the partnerships' activities was transcribed onto log forms by evaluators. Two evaluators categorized events facilitated by the partnerships using

a list of behavioral definitions. Inter-rater reliability was calculated by dividing the number of agreements by the total number of agreements plus disagreements. The scoring system was 82% reliable for log entries in Salina and 86% reliable for Dighton log entries.

Constituent surveys. Evaluators used printed surveys to gather local citizen ratings of the importance of the projects' goals and accomplishments. At the end of the first year, evaluators mailed surveys to community members. Survey participants were selected by partnership staff and included community members who were involved with the partnership either as members of the partnership, teachers, school administrators, or potential partnership supporters. Response rates were 60% in Dighton and 67% in Salina, resulting in 12 completed surveys in Dighton and 14 in Salina. Survey items included a listing of (a) broad partnership goals (e.g., revise school lunch menus to reduce the percent calories) and (b) partnership accomplishments, which were the community

Table 1. Illustrative community changes and dates the changes were initiated in Dighton and Salina.

<i>Example Community Changes Facilitated in Dighton</i>	
<i>Programs</i>	
<ul style="list-style-type: none"> Installed fitness stations in classrooms (4/92); developed curricula (9/92) and an incentive system (3/93) for its use. Sponsored "LEAN Meat—Let's Eat" night with food sampling and an analysis of the nutrition and exercise behavior of five local families. Coordinator made recommendations to the families for improvement and reported their progress in the newspaper (1/93). Collaborated on initiating a fundamentals of basketball and volleyball program for girls (2/94). 	
<i>Policies</i>	
<ul style="list-style-type: none"> Adopted an enhanced physical education curriculum school wide (9/92). Adopted a cycle menu program district wide that will facilitate low-fat product purchasing and menu planning (4/93). School agreed to sponsor an annual health fair at the elementary school (3/93). 	
<i>Practices</i>	
<ul style="list-style-type: none"> Established a monthly column called "LEAN Corner" in the local newspaper (7/92). Initiated a 3- to 5-minute daily stretch program in the classrooms to increase flexibility and develop positive habits for warm-up, cool down, and CVD fitness (10/92). Added a juice vending machine to provide alternatives to soda pop (6/93). 	
<i>Example Community Changes Facilitated in Salina</i>	
<i>Programs</i>	
<ul style="list-style-type: none"> YMCA offered more basketball programs for children concurrent with adult exercise classes (8/92). Sponsored a dietary change program, Leaner Eater, for local teachers and food servers (8/93). Offered cholesterol testing to students, teachers, parents, and community members (9/93). Established parent-child aerobics and line dancing classes at the local YWCA (1/94). 	
<i>Policies</i>	
<ul style="list-style-type: none"> School adopted the fitness components as a permanent part of the physical education curriculum (1/94). School adopted the nutrition education components as a permanent part of the curriculum (1/94). 	
<i>Practices</i>	
<ul style="list-style-type: none"> Foodservice cooks started using exact measurements of ingredients (4/92). Local physicians rotated residents through a community nutritionist's practice to give residents experience in nutrition education (5/93). On-site coordinator and local physician included nutrition education in checkups for children 0–18 years of age at a local health clinic (5/93). 	

changes facilitated by the partnership and collected using the log system (e.g., collaborated with the YWCA to offer new parent-child aerobic classes). The survey asked respondents to rate the importance of the goals and accomplishments on a scale of 1 (least important) to 5 (very important). A section for comments was included to solicit general feedback.

Feeding data back to relevant audiences. Ongoing graphing of community changes, services provided, and community actions, similar to Figures 1 and 2, permitted regular feedback on partnership progress and accomplishments. Initially, feedback was provided monthly, and later quarterly, in meetings with partnership leadership and staff. Feedback enabled the collaborators to detect and celebrate early successes, such as a newly established cycle menu to facilitate meal planning. At times, when rates of community change lessened, staff and evaluators considered what barriers to action or change were being encountered, and whether renewed efforts were called for. Evaluators summarized the results from the constituent survey of goals and accomplishments by calculating the mean and range of the respondents' ratings. Staff and evaluators discussed these data, and staff were encouraged to focus on changes that were highly rated.

Design. A multiple case study design²³ was used to explore the effects of the community partnerships. Data were collected in a time-series fashion²⁵ over 27 months.

RESULTS

This section describes the data secured to answer key evaluation questions about the process and intermediate outcomes of the school and community partnerships.

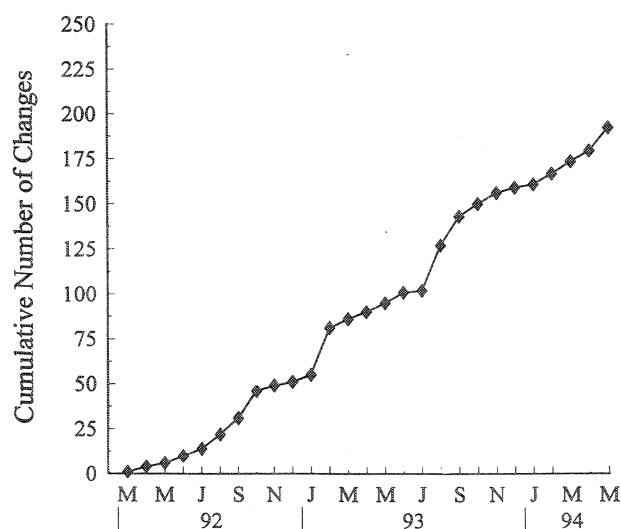


Figure 1. Cumulative number of community changes facilitated in Dighton.

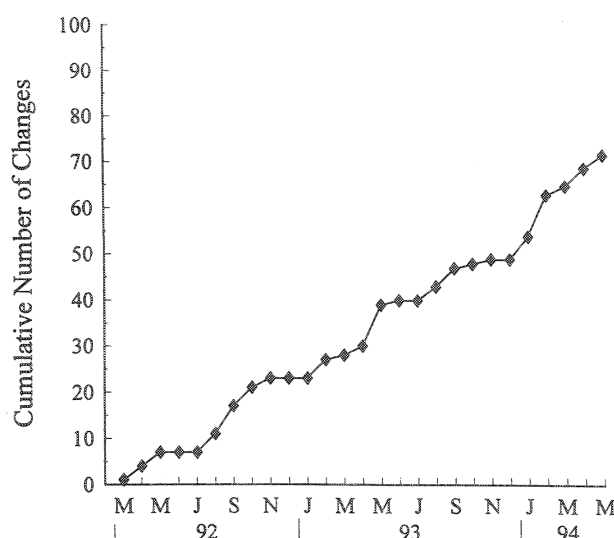


Figure 2. Cumulative number of community changes facilitated in Salina.

Were changes in the community facilitated by the partnerships? Many changes were facilitated in both communities to support the partnership's efforts. Figures 1 and 2 show the cumulative number of community changes (new or modified programs, policies, and practices) produced by the partnerships and reported by staff using the log monitoring system. A steeper line reflects more activity, a flat line indicates no activity. Illustrative community changes, such as initiating summer fitness programs, are noted in Table 1. The partnership in Dighton created over 179 community changes over a 27-month period (see Fig. 1). Cumulative community changes shows a steady climb with increases in the fall, when school opened and planned activities were implemented. Changes facilitated in Dighton included, but were not limited to, many one-time community events on fitness and nutrition, changes in classroom and physical education curricula, menu and recipe changes, changes in community sports leagues, cooking demonstrations, and health screenings.

The partnership in Salina created over 72 community changes during the same 27-month period (see Fig. 2). The partnership created a large number of changes at a steady rate during implementation. Changes facilitated in Salina included collaborating with community agencies to offer family-oriented fitness programs, changes in classroom and physical education curricula, menu and recipe changes, and several one-time fitness and nutrition events such as student dances.

How well were the partnerships implemented? Evaluators also used the log reporting system to collect information about service provision and community action to see how well the partnership was implemented. Both sites provided a high and steady rate of services over 2 years: the total number of services provided and reported in the log system was 162 in Dighton and 129 in Salina. Community actions

are precursors to community changes and can function to reinforce the persistent action needed to bring about community changes. Although staff stated that they under-reported community actions, 61 community actions were reported in Dighton and 92 in Salina.

Were the goals of the partnerships important?

Selected community members rated the importance of the goals of the partnership. The response categories ranged from 1 = "very unimportant" to 5 = "very important." Nearly all of the respondents reported that the goals of the partnership were "important" or "very important" to reducing children's risks for CVD. The percentage of respondents rating the partnership goals as "important" or "very important" in Dighton and Salina, respectively, were as follows: revise school lunches (100%, 93%), increase physical activity (100%, 93%), increase nutrition education at school (100%, 86%), and develop a community partnership (92%, 64%). Overall, 100% of the respondents in Salina and 92% in Dighton reported that the community was better off because of the project.

Were community changes important to the mission?

Surveys of community members were also used to explore the importance of each community change in reducing children's risks for CVDs. Taken together, most respondents rated the changes as "important" or "very important" to reducing children's risks for CVDs in both Dighton (92%) and Salina (92%). Individual changes that were rated as "important" or "very important" to reducing risk by the highest percentage of respondents included changes in food preparation methods (e.g., rinsing ground beef in Dighton, 100%), reductions of fat in recipes (e.g., new cookies and casseroles in Dighton, 100%), and establishing ongoing fitness programs (e.g., family walking program in Salina, 93%). Although most respondents found all changes important or very important, fewest rated new single-day events (e.g., fitness activities at community events in Dighton, 67%) as "important" or "very important" to reducing children's risks for CVDs.

DISCUSSION

This manuscript describes two case studies that illustrate the potential effects of school and community partnerships for promoting cardiovascular health. The results suggest that both partnerships facilitated important changes in the school and the broader community. Implementation of the partnerships varied to reflect the differences in the two communities. Comparing rates of community changes and rates of community actions in the two communities suggests that fewer activities may have been needed to facilitate changes in the smaller community of Dighton. Perhaps tighter social networks in the small, rural community of Dighton enabled change to occur more efficiently.

There were a number of methodological challenges to evaluating these school and community partnerships for cardiovascular health. First, the case study design precludes

causal inferences about the effects of the intervention. Other correlated events, such as increased state- or county-wide interest in diet and exercise, could have contributed to the ease in which changes were made in each community.

Second, the monitoring system is, by design, a reactive measurement instrument. It is likely that recording events for the log monitoring system, such as community changes, prompted additional changes by staff and leadership. In addition, the activities and changes reported may be a conservative estimate of the actual numbers of activities provided and changes made, as it is likely that some events and changes were not reported.

Third, the monitoring system did not track the maintenance of changes over time. Although some of the changes were new one-time events, many were the first of a series of events or changes that have continued years after the grant period was completed (V James, L Henke, personal communication, May 1996).

Fourth, the monitoring system relied on self-reported data. Community changes are not all directly observed by the evaluators. To increase accuracy in reporting, evaluators verified a sample of reported community changes through meeting minutes, newspaper articles, and occasional direct observation. All such checks showed correspondence between events reported and other corroborating evidence that the event had actually occurred and was facilitated by the partnerships.

Fifth, few (26) community members provided feedback on the importance of the projects' goals and accomplishments. Although these data assisted project leadership in setting additional goals, the limited number and intentionally biased sample precludes generalizing the findings to all community members. In addition, community members surveyed may not have had special knowledge of the risk factors for chronic diseases. Future studies should consider expanding the distribution of assessments to include additional community members and experts in fields related to reducing children's risks for chronic diseases (e.g., physicians and researchers).

Sixth, because we lack strong community-level indicators for cardiovascular health, conclusions about the effects of the community changes on more distal health outcomes cannot yet be drawn. However, positive changes on the proximal indicators of nutrition knowledge, physical fitness, and consumption of lower fat foods were found.²⁴

Despite these limitations, this study contributes to our understanding of the processes and intermediate outcomes of school and community partnerships with the mission of reducing children's risks for chronic diseases. Data from these two case studies suggest that the goals and accomplishments of the partnerships were important to the community and were implemented as planned. Staff used data about the importance of goals and accomplishments to set priorities and continue to implement community changes important to their mission. Regular discussions of the cumulative number of community changes, community actions, and services provided also contributed to continued progress of the partnership by providing opportunities to celebrate successes and redirect efforts, if necessary.

Future research is needed to further understand and improve strategies for reducing children's risks for chronic diseases. First, subsequent research should attempt to identify comparison communities to control for changes in secular trends. Second, future research should identify community-level indicators, such as the sale of whole milk versus skim milk, and collect such data for intervention and comparison communities to examine the community-level impact of such school and community partnerships.¹⁸ Finally, future research should establish the maintenance or durability of the changes produced by partnerships.

The collaborative partnerships in Salina and Dighton used elements of a variety of models, including collaborative planning,^{3,7} extensive citizen involvement,^{9,11} and support and evaluation systems.^{3,11} Under the auspices of Kansas LEAN, this school and community partnership model is being replicated in six communities in Kansas. This replication provides additional opportunities for expanding our understanding of the strengths and challenges of community partnerships for reducing risks for chronic diseases among children.

Risks for chronic disease and associated behavior patterns for diet and physical activity are established early in life. The partnerships sought to increase access and opportunities for improved diet and exercise: the aim was to make healthy choices the easy choices.²² These school and community partnerships contributed to improved diet, physical activity, and other protective factors for CVD among children and adults. Perhaps collaborative partnerships will serve as effective catalysts for change, building community capacity to address a variety of health and development concerns.

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Reducing Elementary School Children's Risks for Chronic Diseases through School Lunch Modifications, Nutrition Education, and Physical Activity Interventions

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ABSTRACT Many behaviors, such as physical inactivity or a poor diet, that put adults at risk for chronic diseases are established in childhood. This manuscript describes the outcomes of a comprehensive school health project, the Kansas LEAN School Intervention Project. The Kansas LEAN School Intervention Project in Salina and Dighton had four components, three of which were school based: (a) modified school lunches, (b) enhanced nutrition education, and (c) increased opportunities for physical activity. The fourth component, actions taken by a community partnership, is described elsewhere. Data from two case studies were used to address three primary evaluation questions: (a) did changes in the school lunch menu reduce the fat content yet maintain calories in meals served? (b) did nutrition knowledge, skills, and attitudes of students improve? and (c) did students' physical fitness improve? The findings suggest that the project was successful in reducing the fat content in school lunches in both communities from baseline levels of approximately 38% calories from fat to the target goal of 30% calories from fat during the 1993-94 school year. The schools also maintained adequate calories for students in this age group. Students' knowledge, skills, and behaviors related to nutrition as well as their physical fitness improved in both Kansas communities. The strengths and limitations of this strategy of making healthy choices easy choices through school-based intervention are discussed.

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INTRODUCTION

Heart disease is the leading cause of death in the United States.¹ Poor diets and physical inactivity, which are risk factors for cardiovascular diseases, are established early in life.²⁻⁴ Research suggests that approximately 50% of children have at least one modifiable risk factor for coronary heart disease by age 12.⁵ Schools are an important channel for prevention programs. Approximately 60% of school children in the U.S. participate in school lunch programs and these students receive more than one-third of the Recommended Dietary Allowances for food energy and key nutrients at school.⁶ Schools also have the capacity to disseminate nutrition education and promote physical activity, reaching large numbers of children.

Several school- and community-based health initiatives have successfully reduced risk factors for chronic diseases among youth. These have used a variety of strategies, including modifying school lunches,⁷⁻¹⁰ increasing physical activity,⁹⁻¹² providing nutrition education,¹³⁻¹⁵ and implementing mass media campaigns.^{14,16,17} Few studies, however, have examined the impact of multiple components of a school intervention within the context of a community partnership to reduce risks for chronic diseases.

This paper describes the evaluation of three components of a comprehensive school health intervention designed to change the environment to affect health-related behavior and outcome by (1) modifying school lunches, (2) enhancing nutrition education, and (3) increasing opportunities for physical activity. Community changes introduced by establishing a community partnership to support the changes are described elsewhere.¹⁸ First, we describe the context and collaborators of the project. Second, we describe the major components of the Kansas LEAN School Intervention Project. Third, we describe the measurement system and results for the key evaluation questions. Last, we discuss the challenges and opportunities of designing and evaluating comprehensive school interventions.

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Work was conducted in the Kansas communities of Salina and Dighton in conjunction with Unified School Districts 305 and 482.

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METHODS

Kansas LEAN,¹⁹ a program of the Kansas Department of Health and Environment, Bureau of Chronic Disease and Health Promotion and the Kansas Health Foundation, designed and facilitated the implementation of the Kansas LEAN School Intervention Project. The Kansas Health Foundation provided funding over 2 years to design and pilot test the project. The Kansas LEAN Director, a registered dietitian, provided project oversight and direction. Two registered dietitians worked on site for approximately 20 to 30 hours per week assisting foodservice staff, classroom teachers, and physical education (PE) teachers in conducting nutritional analysis of menus, modifying menus, implementing enhanced nutrition education in classrooms, and enhancing fitness activities. The Work Group on Health Promotion and Community Development at the University of Kansas (KU Work Group) provided technical assistance and evaluated the project.

Communities and schools. The communities of Salina and Dighton, and their respective school districts, agreed to implement the program. The two communities were selected

to represent two different-sized communities and school districts in Kansas. Salina (population 42,300) is relatively urban with over 6000 students and 15 schools in the district. Cooks prepared school meals for the district in four centralized kitchens. By contrast, Dighton (population 1400) is a rural, geographically isolated community with an economy based on farming and ranching. The school district served 400 students and meals were prepared at one central kitchen. In Salina, all 4th graders in one elementary school ($N = 74$) received the intervention; 4th-grade students ($N = 62$) in two other schools in Salina served as a comparison group. In Dighton, all 5th graders ($N = 34$) participated in the intervention. Since there was only one elementary school in Dighton, a comparison group of 5th graders was not available. PE teachers in both schools, 4th-grade teachers in Salina, and 5th-grade teachers in Dighton agreed to participate in designing and implementing the project.

School-based components. Table 1 outlines the three school-based components implemented by each community. The implementation of each component varied between the two communities and is briefly described below.

Table 1. School-based components and elements of the Kansas LEAN School Intervention Project to reduce children's risks for chronic diseases.

<i>Components</i>	<i>Elements</i>
Modify school lunch	<ul style="list-style-type: none"> (a) Recording nutritional content of menu items (e.g., measuring or weighing and recording ingredients) (b) Determining nutritional content of products (e.g., requesting dietary information from food vendors) (c) Receiving feedback (before and after modifications) on the percent calories from fat and calories in menu items and menu combinations (d) Modifying food preparation techniques (e.g., rinsing cooked ground beef in hot water before serving) (e) Modifying recipe ingredients (e.g., substituting nonfat yogurt for mayonnaise in salads, dips, dressings, and tartar sauce) (f) Modifying products ordered from vendors (e.g., lower fat fish sticks) (g) Changing menu combinations to reduce percent calories from fat in overall weekly menus (h) Locating or assisting vendors to develop new products (e.g., developing products with a higher percentage of wheat flour)
Provide nutrition education	<ul style="list-style-type: none"> (a) Assisting teachers and administrators to integrate the American Cancer Society's Changing the Course (CTC) into health units or core subjects (e.g., math, English) (b) Providing training for teachers on nutrition and using CTC (CTC included individual worksheets, food tasting, small-group activities, field trips, and class discussion) (c) Arranging for coordinators, community volunteers, or foodservice employees to serve as role models and provide general assistance (d) Facilitating field trips and special activities (e.g., supermarket tours, lunch at McDonald's) (e) Providing incentives for teachers to implement the curriculum (e.g., \$100 for classroom materials)
Increase physical activity	<ul style="list-style-type: none"> (a) Installing physical fitness stations in each classroom, which consisted of individual workbooks (e.g., readings on fitness, songs about nutrition) and optional physical fitness activities (e.g., stretching, sitting, and reaching) (b) Initiating a noncompetitive incentive system based on students' personal goals (e.g., students earned class parties for using the fitness stations) (c) Training of PE teachers in how to increase the amount of time students engaged in cardiovascular fitness activities (d) Providing lesson plans for PE teachers with enhanced variety and intensity of physical activity (e.g., games, music, and dance)

School lunch. Changing school lunches to reduce dietary fat while maintaining both adequate calories and food acceptability was one of the primary goals of this project. The director of Kansas LEAN and two on-site coordinators provided training, technical assistance, and direct support to foodservice professionals in the school districts. Coordinators used workshops, one-on-one training, coaching, and modeling to train foodservice workers. The training was informal and collaborative, and changes were made gradually as foodservice staff became comfortable with new food preparation techniques and products. Foodservice staff made many recommendations that were incorporated into routine kitchen practices. To maintain acceptability of the new foods served, potential food products and recipes were evaluated with food tasting panels consisting of students, parents, foodservice staff, and teachers.

The foodservice programs in Salina and Dighton differed in size, location, and experience of foodservice professionals. Assistance provided to the two programs differed to respond to the unique challenges and opportunities in each community. For example, training in Dighton focused on food preparation techniques to lower fat because nearly all menu items were prepared from scratch. By contrast, food served in the Salina district was purchased frozen from vendors, prepared in central kitchens, and delivered to school cafeterias. Accordingly, training in Salina focused on ordering from vendors and locating or assisting vendors in the development of new products.

Nutrition education. Project coordinators collaborated with elementary school teachers and school administrators to implement the American Cancer Society's (ACS) nutrition education program, *Changing the Course* (CTC).²⁰ The goals of the curriculum were for students to eat a variety of fruits and vegetables, more high-fiber foods, and fewer higher fat foods. The curriculum focused on teaching healthy food choices, rather than labeling foods as "good" or "bad." The curriculum was behaviorally oriented and activity based. The ACS provided teachers with the CTC Upper Elementary curriculum and teachers' handbooks.

Physical activity. Each community enhanced opportunities for physical activity by installing classroom fitness stations and modifying PE classes to increase the proportion of time spent on cardiovascular fitness activities.

Evaluating the school-based components of the partnerships. Evaluators and project staff designed the evaluation system to examine outcomes of the project and to facilitate continuous improvement of the project's efforts. There were several key evaluation questions of interest to the staff and leadership of the community partnerships. Questions related to the school components included (a) did changes in the school lunch menu reduce the fat content and calories in foods served? (b) did nutrition knowledge, skills, and attitudes of students improve? and (c) did the physical fitness of students improve? To address these key questions, the eval-

uation system used three measurement instruments: (a) menu analysis, (b) a review of foodservice records, and (c) student surveys on nutrition and fitness. In addition, evaluators used a measure of community change²¹ to track implementation of innovations in nutrition education, school lunch, and PE; community change data are reported elsewhere.¹⁸ The measures, methods for data collection, feedback systems, and statistical analysis are described in the sections below.

Menu analysis. School foodservice menus were analyzed using Nutritionist IV,²² a computerized menu analysis program that used an extensive database of nutrients for specified foods. Menus were analyzed in several stages: (1) local foodservice employees recorded foods included in each recipe by weighing or measuring quantities, (2) the dietitian entering the data contacted local foodservice employees to clarify quantity or ingredient information, as necessary, (3) foods for each recipe were entered into Nutritionist IV, (4) printouts of the nutrients for each recipe and menu combinations were sent back to foodservice employees, (5) foodservice employees modified the menus to reduce dietary fat and maintain calories, and (6) steps 1 and 5 were repeated until percent of calories from fat and total fat were within target. Prepared products were entered into the database using manufacturers' nutritional analysis data. A registered dietitian conducted an analysis of recipes and menus for all menu combinations during baseline (3 months in Dighton and 5 months in Salina) and after menu changes (7 months in Dighton and 8 months in Salina).

Review of foodservice records. Archival records were reviewed, including school attendance, meals served in the lunch program, food costs, and personnel expenses. Where possible, data from the records were used to calculate the cost and percentage of students participating in the school lunch program.

Student surveys. Surveys were used to assess students' knowledge, skills, and attitudes related to nutrition and students' physical fitness. Surveys were administered to students before and after the intervention was implemented. Paper and pencil assessments developed to accompany the CTC Lower (66-item) and Upper Elementary (53-item) curricula were used to assess the effectiveness of the nutrition education curriculum in Salina (Lower) and Dighton (Upper). Teachers administered the assessments, which took about 45 minutes to complete, during school hours. The assessment included items related to knowledge (e.g., "It is a good idea to eat a variety of foods each day"), skills (e.g., "Identify high-fat foods"), and attitudes (e.g., "All people like the same foods"). A formative evaluation of the CTC curriculum²³ reported that the test items were written at age-appropriate levels and that teachers were highly satisfied with the curriculum. Researchers who conducted this evaluation also used a review of experts to establish that the assessment had high content validity and calculated Cronbach's alpha reliability

coefficients, which were .79 and .92 on the upper and lower upper elementary assessment, respectively.²³

The Amateur Athletic Union (AAU) physical fitness assessment²⁴ was used to assess the impact of increased opportunities for physical activity on students' fitness. Project staff and a fitness expert trained the PE teachers to administer the assessment, a behavioral observation designed to measure students' strength, muscular endurance, cardiorespiratory endurance, and flexibility. Students demonstrated their fitness in five required events (such as pull-ups and endurance runs) and six to seven optional events (such as long jumps and sprints). Students' performance levels were categorized based on age and national AAU fitness standards.²⁴ Attainment and Outstanding levels from the AAU corresponded to the 45th and 80th percentiles of sample scores.

Feedback. The intervention model called for regular reports on all key measures, including (a) menu analyses; (b) students' nutrition knowledge, skills, and attitudes; and (c) students' fitness. Regular feedback on menu revisions was delayed until late in the project because of the amount of training involved in getting the menu reporting and data entry systems in place. Students' levels of nutrition knowledge, skills, and attitudes as well as fitness were graphed and fed back to project staff after assessments were administered.

Design and statistical analysis. An interrupted time-series analysis²⁵ was used to analyze data on nutritional content of menus over time in Dighton and Salina. Individual level data on students' knowledge of nutrition and levels of physical fitness were assessed using pretest-post-test group designs²⁵ with a comparison school in Salina and replications of findings in Dighton. Statistical tests, performed using SPSS for Windows,²⁶ were used to conduct statistical analysis of individual level data. A two-tailed dependent t-test²⁷ was used to examine the differences before and after the intervention was implemented for (a) nutrition knowledge in Dighton and (b) a fitness indicator in Salina. Effect sizes were analyzed using the *d* statistic.²⁸ The McNemar Change Test²⁹ was used to test differences in fitness scores in Dighton. An *f* ratio²⁸ was used to analyze differences in nutrition knowledge between students who received the intervention and those who did not. An R^2 proportion was used to measure the strength of association between the variables.

RESULTS

This section describes the findings organized under several key evaluation questions about the school-based components of the partnerships.

Did changes in the school lunch menu reduce the fat content and maintain calories in foods served? After the intervention was implemented, the fat content of school lunches was reduced to target levels while maintaining or

increasing total calories in both sites. Figure 1 shows daily averages of calories and percent calories from fat in the school lunch menus served during the 1993–94 school year and percent calories from fat during baseline for the project in Dighton. Baseline levels of percent calories from fat were calculated using menu data from the first 3 months of the grant period (October–December 1992). Mean percent calories from fat fell from baseline levels of 40% to the target level of 30% during the 1993–94 school year. After menu modifications, total calories ranged from 767 kcal to 830 kcal, which is above the target level of 750 kcal.

Figure 2 shows trends in average daily caloric and fat content of the Salina school lunch program. Mean percent calories from fat decreased from baseline levels of 38% to the target level of 30% after menus were modified. Mean calories per month increased from baseline levels of 738 kcal to 821 kcal in the second year of the project.

Reviews of foodservice records showed that participation in the school lunch program remained relatively constant in the two communities as the menus changed. The accounting system in Salina did not separate expenses in a way that allowed researchers to calculate the cost per meal. Data on the cost of the lunch program were available for Dighton and showed that the cost increased less than 5%. This may be due to economic inflation and an increased number of portions consumed by each student (e.g., more students going back for "seconds"), and not to higher costs of lower fat menus.

Did nutrition knowledge, skills, and attitudes of students improve? The percentage of youth who answered the nutrition knowledge, skills, and attitude questions correctly or favorably increased significantly from pretest to post-test in Dighton. In Salina, intervention students' scores were significantly higher when compared to students who did not receive the curriculum in Salina. In Dighton, intervention students' performance on the Upper Elementary Assessment increased from pretest (71%) to post-test (84%), and the increase was maintained at a 1-year follow-up (83%). Changes from pretest to post-test were statistically significant

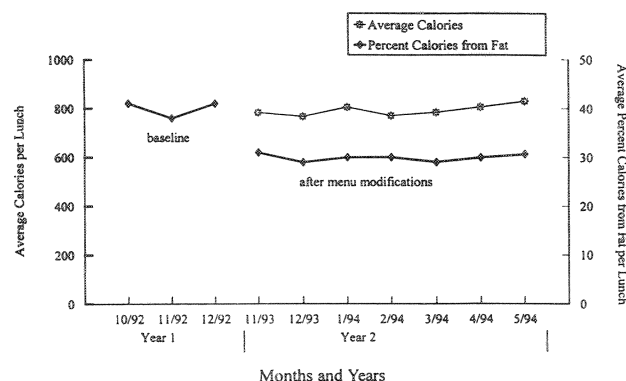


Figure 1. Trends in fat and calorie content in school lunches for Dighton.

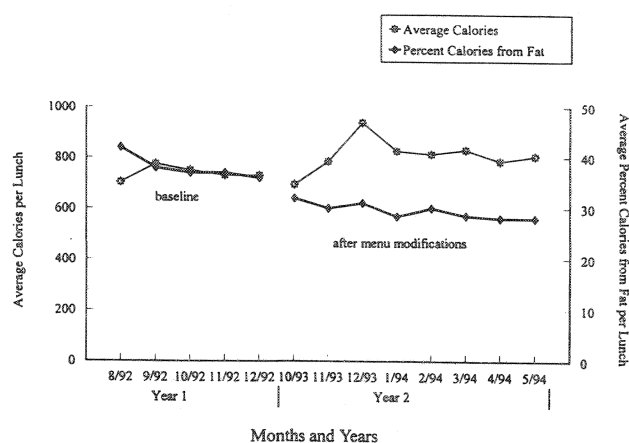


Figure 2. Trends in fat and calorie content in school lunches for Salina.

($t[33] = -6.64, p < .0001$) with a very large effect size (d statistic = 6.9). These findings were replicated with 5th graders receiving the same curriculum in the following year; their knowledge increased from pretest (68%) to post-test (83%). In addition, the lower performance scores (66%) of 5th graders (who had not received the curriculum) at the end of the previous year suggested that the findings were due to the curriculum rather than maturation.

Fourth-grade students who received nutrition education in Salina scored higher at post-test on the Lower Elementary Assessment (82%) than students who did not receive the enhanced nutrition education (74% and 72%). Difference between these scores is statistically significant ($F[2,133] = 20.179, p < .0001$) with a large proportion of variability due to differences between groups ($R^2 = .2328$).

Did youth physical fitness improve? Analysis of the fitness data suggests that fitness levels of the intervention students increased from pretest to post-test and, in Salina, intervention students were more fit than similar students who did not participate in the project. The percentage of Dighton students experiencing the intervention who performed at or above the AAU Fitness Attainment level increased from pretest (18%) to post-test (29%). These differences, however, were not statistically significant ($p = .29$). The small number of intervention students may not have provided enough power to detect any potential statistical significance.

The AAU Fitness Assessment was modified slightly in Salina. In the "Endurance Run" event, students ran 1 mile rather than the standard 3/4 of a mile. Overall performance awards, therefore, could not be determined for students in Salina. The endurance run event was selected for analysis because it is a measure of cardiorespiratory endurance and is the event that is most closely linked to reduced risks for cardiovascular diseases. In Salina, compared to same-grade students in comparison schools, intervention students showed a larger reduction in the amount of time taken to complete

the mile run from pretest to post-test. Girls in the intervention group reduced their average time by 1.21 minutes while girls in the comparison group reduced their average time by only 0.32 minutes. Boys in the intervention group reduced their average time by 1.76 minutes while boys in the comparison group reduced their average time by 0.64 minutes. The differences between comparison and intervention students' performance changes from pretest to post-test were statistically significant for both girls ($t[48] = 2.60, p = .012$) and boys ($t[59] = 2.19, p = .033$).

DISCUSSION

This manuscript describes two case studies of the school-based components of the Kansas LEAN School Health Project. The results suggest that the projects in Salina and Dighton facilitated important changes in the school to reduce youth risks for chronic diseases. Each community facilitated changes of the school lunch menus, including adopting new food products, revising recipes, and developing new menus. These changes resulted in reduced fat and maintained calories in school lunch menus without negatively influencing costs or participation. Further, nutrition knowledge, skills, and attitudes as well as physical fitness improved among participating students in both schools.

There were several challenges to evaluating the school-based components of these partnerships. First, without randomized control groups, conclusions about the strength of the intervention's effects are limited. Other events, such as the national interest in diet and exercise, could have contributed to the effects. However, attempts were made to control for such confounding variables, such as using comparison schools in Salina and comparison groups in Dighton, for the nutrition education and fitness assessments. No data from control or comparison groups were available for changes in the school lunches. Although comparison groups would have helped rule out other possible explanations of the observed effects, establishing a control group was not seen as feasible given the complexity of conducting nutrient analysis.

Second, a strength of the AAU Physical Fitness Assessment is the reliance on direct observation of students' fitness rather than self-reports. However, one drawback is that students may not consistently perform to the best of their ability and single assessments may not accurately assess their fitness. The assessment is time consuming, prohibiting multiple administration in this community demonstration.

Third, this study assessed changes in students' knowledge, skills, and behavior related to nutrition using assessments developed and tested by other researchers. Since the assessments were not pilot tested locally, our understanding of the findings may be limited. In addition, to maintain consistency across multiple testing of the intervention students in Salina, the Lower Elementary assessment was used to assess 4th graders, who were beyond the recommended age range for this assessment.

Fourth, the accuracy of the nutritional analysis was not systematically verified by laboratory studies. Further, the measurement system was intentionally reactive: documenting the fat content of foods served was intended to draw attention to the foods' nutritional content and prompt kitchen staff to modify menus. In addition, as a result of multiple computer-related problems, summarized nutrition information was not available to project staff until after the project was completed; foodservice staff made menu and recipe revisions without complete and ongoing information on the fat content of menus. Overall, however, nutrient analysis data collected over a 2-year period strongly suggest that the project successfully met its goals for revisions in school lunches. Finally, data on the actual consumption of school lunches are not available. Plate waste studies were attempted but abandoned due to large variability in consumption and a lack of staff time and resources to conduct frequent plate waste studies. However, taste testing and sampling were conducted with students and foodservice staff to help assess the palatability and the likelihood of consumption of the school lunches.

Despite these limitations, the findings from this multiple case study contribute substantially to our understanding of nutrition education, physical activity opportunities, and changes in foods served during school lunch to reduce children's risks for chronic diseases. The data suggest that the major components of the intervention were implemented, and positive changes in nutrition knowledge and physical fitness were found among participants. Further, increasing opportunities for healthier school lunches increases the likelihood that children might consume fewer calories from fat when in school.

Future research is warranted to extend understanding about and improve methods for reducing children's risks for chronic diseases. First, future research should attempt to identify comparison communities. Second, future research should attempt multiple assessments of physical fitness and food consumption. The Kansas LEAN School Intervention Project is being replicated in six communities in Kansas. These applications of the school and community components should help to extend our understanding of the strengths and challenges of such interventions that have the mission of reducing risks for chronic diseases among children.

The overarching strategy of the Kansas LEAN School Intervention Project is to change the environmental context for children's health-related behaviors. By modifying school lunches, the opportunities for selecting (and potentially eating) lower fat foods is enhanced. By enhancing students' knowledge and skills through behaviorally based nutrition education, selections of healthy food choices may be improved. By increasing opportunities for school-linked physical activity, children are more likely to engage in those behaviors associated with fitness. Rather than blame children (or their parents or teachers) for engaging in health risks, this approach demonstrates how environmental changes may improve health behavior. In so doing, it illustrates a fundamental tenant of public health: make healthy choices easy choices.

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Institutionalizing community change: An empirical study with a community-based project for reducing risks for chronic diseases.

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Dighton partnership

- Funded 1992 - 1994
 - Part-time coordinator
 - Teacher incentives
 - Menu analysis
 - Data collection & analysis
- Maintenance measured 3 years later (1997)

What did we measure?

- Community changes (N=68)
 - New or modified programs, policies, practices
 - Intended one-time events removed
- Examples
 - Lower fat milk served
 - LEAN Kids track meet
 - Resource materials available

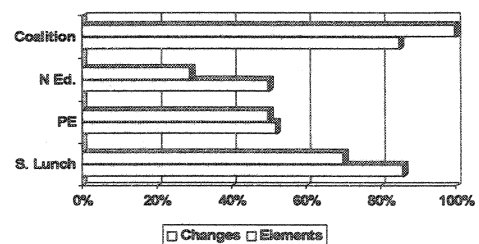
What did we measure?

- Project's core elements (N=30)
 - Related to:
 - Coalition
 - School lunch
 - Nutrition education
 - Physical activity
- Examples
 - Classroom activities related to nutrition
 - Facilitating leadership in the community

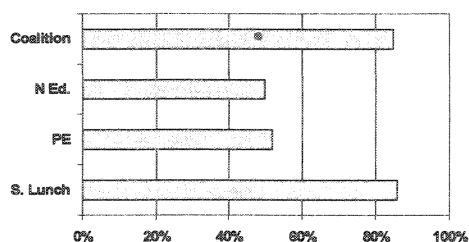
How did we measure it?

- Written key informant survey
 - "Generally, is it still happening?"
- Administered to 14 community experts
- 4-6 experts per component
- Confidential

What was still happening?



Changes still happening



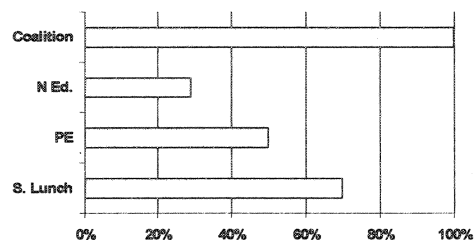
Example changes maintained

- Standard recipes
- CTC nutrition education
- Students earn points for home exercise
- Stronger girls' athletic program
- Juice machine

Example changes not maintained

- Food service newsletters
- Recess doesn't follow lunch
- School parties have health snacks
- Community fitness trail

Elements still happening



Example elements maintained

- Recording nutritional content
- Modifying PE to increase activity
- Classroom nutrition activities
- Changes in the community to support school changes

Example elements not maintained

- Promoting lunch program
- Fitness stations
- Training PE teachers to increase fitness
- Integrating NE into core subjects
- Teacher incentives

Suggestions

- Target future implementers directly
- Develop cheer leaders
- Tie changes to:
 - QPA
 - Curriculum
 - Outcomes

Suggestions

- Make changes visible
- Plan for minimal resources needed